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Fermilab's Dynamic Displays System

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Fermilab's Dynamic Displays System

1. Overview: What and why
2. Usage
    a. *How to operate the system*
        - *Most of this is off topic for you at Mu2E*
    b. *Changing the default channel*
3. Adding new content
4. Security
5. More features

1. Overview: Digital Signage

- In the *Real World*
  - *Digital signage […] dynamically delivers information, including live and on-demand video, graphics, animations, text, and other Web content, on a high-quality display to a targeted audience at a targeted time.*
- Widespread
  - *Fast Food menus*
  - *Kohl's kiosks*
  - *Airports*
  - *Etc.*

Fermilab's Dynamic Displays System

The Fermilab Dynamic Displays system is a **digital signage** solution that is tailored to work well in our Remote Operations Centers (**ROC**s), and elsewhere, at the lab.

It is a means for showing, and controlling, digital content on high-definition displays around the lab.

From https://dynamicdisplays.fnal.gov/about.php:

This system allows ordinary people to perform the following operations:

- ***Changing*** *the visible content on a display(s) at any time.*
  - A simple GUI, the ChannelSelector, is provided at each location so the untrained user can change the content.
- ***Creating*** *content that can be shown on any display.*
  - Web pages of all sorts; note especially that it can show YouTube videos.
- ***Adding images*** *to slide shows that can be shown on any display through the Experiment Portfolios.*

Dynamic Displays: Main Features

- Any display can show any channel
- Anyone can change the channel at any time
- Anyone can create and add new channels
- Content = Channel = Web Page (URL)

Dynamic Displays: Main Features

- Any display can show any channel
  - *Only one display at Mu2E, so this is not particularly relevant*
- Anyone can change the channel at any time
  - *You need a Channel Selector*
- Anyone can create and add new channels
  - *Security considerations*
- Content = Channel = Web Page (URL)

Glossary

- **Display:** PC-backed monitor
- **Channel:** Content shown on a display
- **Channel Selector:** GUI that allows you to change the channel

Dynamic Displays Use Case concepts

- Inexpensive
- Show pretty and/or useful information in the ROCs
- Allow docents to change the channel on the displays in the ROCs
- Provide low-barrier content creation
- Uptime > 99%
- Prevent inappropriate content

Dynamic Displays Use Case concepts

- Inexpensive
  - *No licensing fees*
  - *Commodity hardware*
- Show pretty and/or useful information in the ROCs
  - *Lots of photographs*
  - *YouTube videos*
- Allow docents to change the channel on the displays in the ROCs
  - *The Channel Selector GUI*
  - *Messaging system from the GUI to a Display*
- Provide low-barrier content creation
  - *All content is web pages*
- Uptime > 99%
  - *Lot of log files and status information is recorded, locally and in the database*
- Prevent inappropriate content
  - *Only approved channels can be shown*

Dynamic Displays Use Case concepts

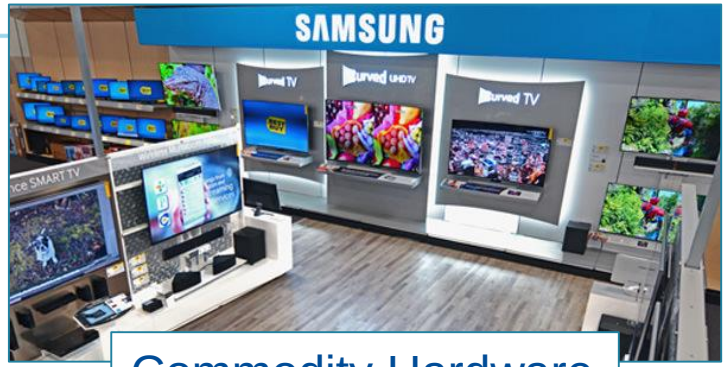
- Inexpensive
  - *No licensing fees*
  - *Commodity hardware*
- ~~Show pretty and/or useful information in the ROCs~~
  - ~~*Lots of photographs*~~
  - ~~*YouTube videos*~~
- ~~Allow docents to change the channel on the displays~~
  - ~~*The Channel Selector GUI*~~
  - ~~*Messaging system from the GUI to a Display*~~
- Provide low-barrier content creation
  - *All content is web pages*
- Uptime > 99%
  - *Lot of log files and status information is recorded, locally and in the database*
- No inappropriate content (!)
  - *Only approved channels can be shown*

Greg, 11/25/2020:

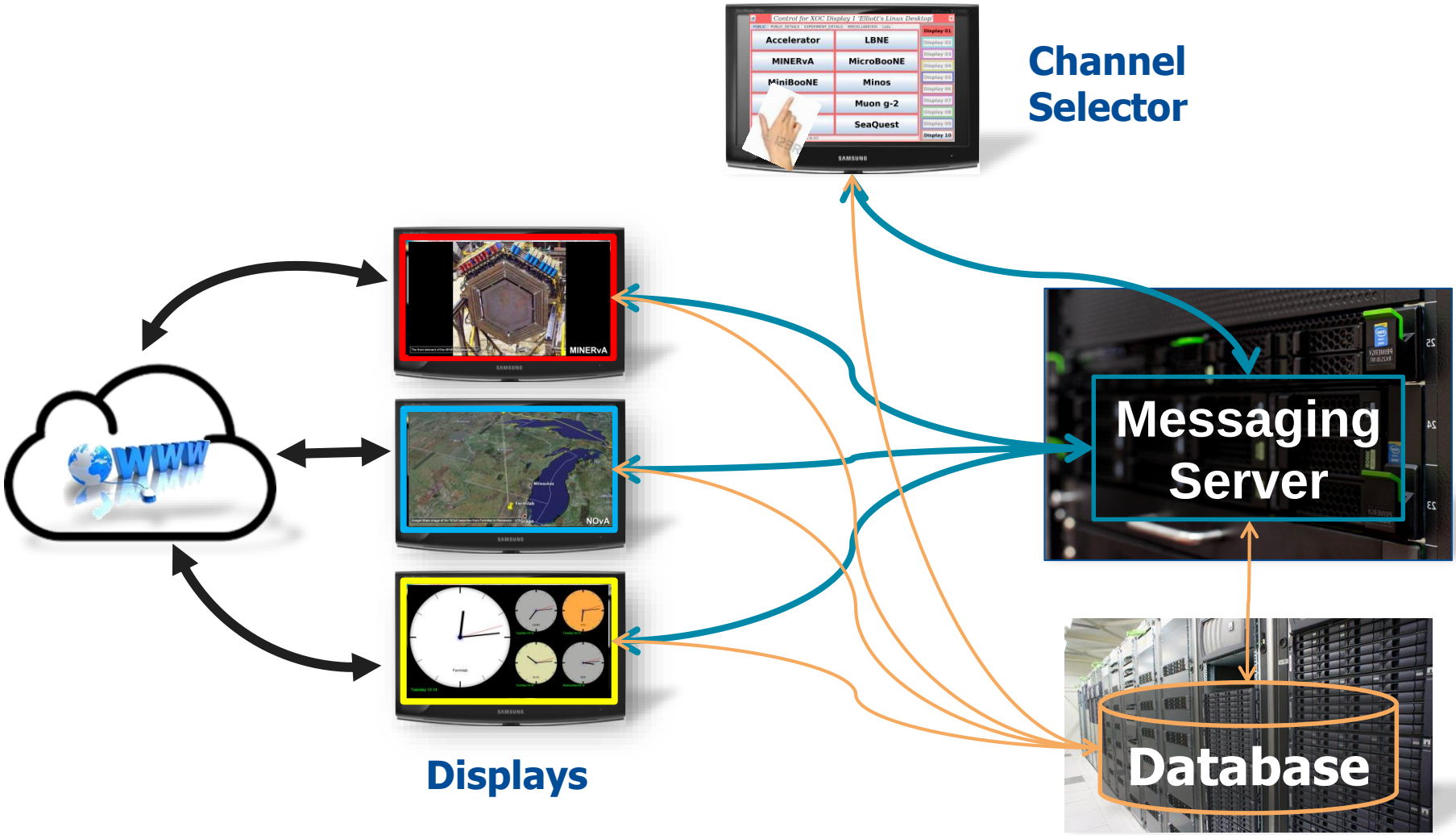
"Note that we are not really interested in having pictures displayed on this display because it would distract from showing the schedule, which is what we need to show all the time. This isn't a public display, so it doesn't need to be pretty. "

Dynamic Displays System: Components

- Displays: Commodity HDTV and 4kTV
  - *Driven by commodity computers*
    - Scientific Linux Fermilab (SLF) 7.x or CentOS 8.x
    - FireFox web browser
    - Custom Java client software
- Channel Selector
  - *In ROC-W, ROC-E and MINOS, running W10*
  - *Custom Java software*
- Backend MySQL database
  - *Hosted by MariaDB servers in CCD*
- Messaging server
  - *Custom Java software, hosted on virtual Linux PC in CCD*



Commodity Hardware


Control for XOC Display 1 'Elliott's Linux Desktop'
Accelerator
LBNE
MINERvA
MicroBooNE
MiniBooNE
Minos
Muon g-2
SeaQuest
Channel Selector
MINERvA
NOvA
WWW
Messaging Server
Database
Displays

Questions?

2. How to use the Dynamic Display system

1. Overview: What and why
2. Usage
    a. How to operate the system
    b. Changing the default channel
3. Adding new content
4. Security
5. More features

How others use the Dynamic Display System

- The Channel Selector
- The Experiments Portfolio
- Adding content

How Mu2E will use Dynamic Displays

- ~~The Channel Selector~~
- ~~The Experiments Portfolio~~
- Changing the default channel on a display
- Adding content

Greg, 11/25/2020:

"Note that we are not really interested in having pictures displayed on this display because it would distract from showing the schedule, which is what we need to show all the time. This isn't a public display, so it doesn't need to be pretty. "

The Channel Selector (abbreviated)

- An application that allows you to change the channel on any display
  - *Note: A channel can be a list of channels*
- Can be run
  - *Full-screen: touch panel*
  - *In a window on your PC*

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The Channel Selector (abbreviated)

- See

  dynamicdisplays.fnal.gov/aboutSelector.php

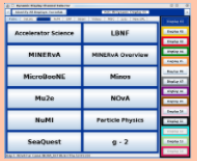
The Channel Selector for the Fermilab Dynamic Display System

The Channel Selector is a Java GUI that gives ordinary users the ability to change the channels on any of the displays in their location. The three main locations for the Dynamic Displays system, the ROC-West, the ROC-East, and the MINOS surface building, have a dedicated, touch-screen PC for changing the channel on any of their displays. Every other location has a Channel Selector installed somewhere.

Here is the where the Channel Selectors are at some of the locations:

- **ROC-West:** At the entrance -- a dedicated touch-screen PC
- **ROC-Eest:** To the right of the entrance, at the end of the fourth console desk -- a dedicated touch-screen PC
- **MINOS:** At the display near the roll-up door -- a dedicated touch-screen PC
- **WH12:** On the same screen as the left display at the elevators: Use ALT+TAB on the keyboard to find it
- **MCR:*** On the Crew Chief's Windows PC
- **WH2E:*** On E. Gottschalks's PC
- **WH8:*** On N. Weidman's PC

* Run the Windows "Batch" script called "runSelector.bat"



The Channel Selector GUI

To gain the authority to run a channel selector on a new computer, it is necessary to jump through a few security hoops. These obstacles are delineated in the documents stored here. Contact Elliott McCrory for assistance.

Some special features of the Channel Selector are:

- Creating, saving, restoring, and manipulating **lists of channels**
- The **Super Button** – allowing the save/recall of channels for all the displays in a location
- The **Docent Tab** for allowing quick and easy access to common content for tour groups
- The **Simplified Display tab**, which lists the most common content that is shown on a given display

More on these features, and how to use them, someday. Ask McCrory for specific instructions.

Dynamic Displays Home | About | List of Displays (Status 3 4) | List of Channels | Experiment Portfolio (List) | Login

Return to Fermilab Home Page
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The Experiments Portfolio (abbreviated)

- An important add-on to Dynamic Displays
- A simple, effective way to show photographs
- There are dozens of different “experiments”
  - *This would be better called “categories”*

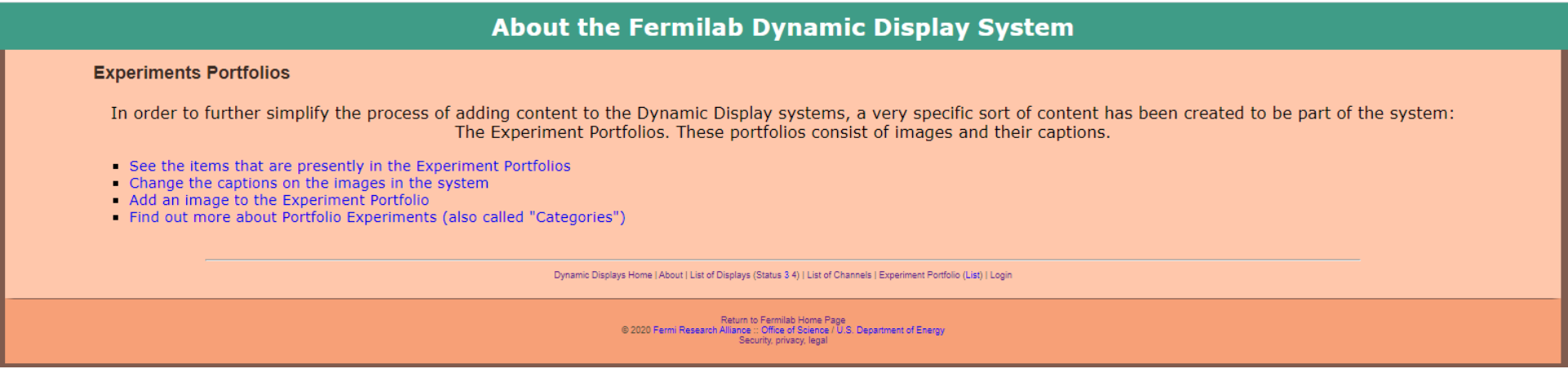
The existing "Experiments"			
Accelerators (15 images | 360 secs total duration) X	ANNIE (27 | 648) X	ArgoNeuT (8 | 192) X	CHIPS (26 | 624) X
CMS (55 | 1320) X	CMSSketchUp (43 | 1032) X	COVID19 (3 | 72) X	DES (15 | 360) X
DUNE-LBNF (25 | 600) X	DUNE_Faces (172 | 4128) X	FAST (85 | 2040) X	Fermilab (77 | 1848) X
FermilabV (33 | 792) X	GinoBolla (11 | 264) X	gMinus2 (27 | 648) X	HarryPPT (13 | 312) X
Hawking (4 | 96) X	Homework (3 | 72) X	ICARUS (18 | 432) X	IcarusTrip (12 | 288) X
LArIAT (40 | 960) X	LArIAT_2016 (57 | 1368) X	Lederman (14 | 336) X	Lee (4 | 96) X
Linac Welcome TV01 (30 | 720) X	Linac Welcome TV02 (35 | 840) X	Matteo_Renzi (25 | 600) X	MCR1 (26 | 624) X
MCR2 (24 | 576) X	MI 20 (32 | 768) X	MICE (7 | 168) X	MicroBooNE (61 | 1464) X
MINERvA (17 | 408) X	MINERvA Celebration (41 | 984) X	MiniBooNE (3 | 72) X	MINOS (22 | 528) X
MINOS_Celebration (80 | 1920) X	Mu2E (13 | 312) X	Neutrino Vertical (19 | 456) X	None (1 | 24) X
NOvA (36 | 864) X	NOvA Publications (2 | 48) X	NPC (2 | 48) X	NuMI (14 | 336) X
pdf (3 | 72) X	PhotoWalk2015 (23 | 552) X	PIP-II (14 | 336) X	PIP-II Ground Breaking (90 | 2160) X
PPDO (102 | 2448) X	ppt (8 | 192) X	ProtoDUNE (28 | 672) X	SBND (19 | 456) X
SeaQuest (5 | 120) X	select (1 | 24) X	SimoneMarcocci (2 | 48) X	SPW (73 | 1752) X
UUP (11 | 264) X			

All Portfolio Pictures (1656 images, total)

The Experiments Portfolio (abbreviated)

- See

  `dynamicdisplays.fnal.gov/infoPortfolios.php`



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Changing the channel at Mu2E

- Assume: channel changes are infrequent
- Then, you will change the default channel in the database and reboot the display PC
  - *This takes about 5 minutes*

Questions?

How to change the default channel on a display

Each node receives initialization specs from the database

Changing the default content

- Since this is not a requested feature (yet), it is done only through editing the database

- Edit
  - *table: Display*
  - *field: Content*

The back-end MariaDB database

MariaDB

From Wikipedia, the free encyclopedia
(Redirected from Mariadb)

MariaDB is a community-developed, commercially supported fork of the MySQL relational database management system (RDBMS), intended to remain free and open-source software under the GNU General Public License. Development is led by some of the original developers of MySQL, who forked it due to concerns over its acquisition by Oracle Corporation in 2009.[6]

Display tables

Table Display

Field	Type	Key	Description
Location	char(255)		Textual name of the place this display is installed
Content	int(11)		The default content to show
DisplayID	int(11)	PRI	Internal database key
IPName	char(100)		The IP Name of the display computer, e.g., display01.fnal.gov
ColorCode	char(6)		What is the color used for this display
VirtualDisplayNumber	int(11)		The display number used within a location

Table DisplaySort

Field	Type	Null	Key	Description
DisplayID	int(11)	NO		Internal database key of the display
LocationCode	int(11)	NO		The location of this display, e.g., “ROC-West”
DisplaySortID	int(11)	NO	PRI	Internal database key

Default content for displays

Location	DisplayID	Content
ROC-W Dynamic Display 01	1	7
ROC-W Dynamic Display 02	2	56
ROC-W Dynamic Display 03	3	11
ROC-W Dynamic Display 04	4	2
ROC-W Dynamic Display 05	5	5
ROC-W Dynamic Display 06	6	35
ROC-W Dynamic Display 07	7	9
FESS-FSM Display 03	20	112
ROC East Display 05	47	79
AD Computer Room Left Display	49	-22
…		
WH10W Elevators	98	254
Mu2E Entrance	99	-86

Positive: Plain channel
Negative: Channel list

Table Display database access

- https://dynamicdisplays.fnal.gov/displayEdit.php

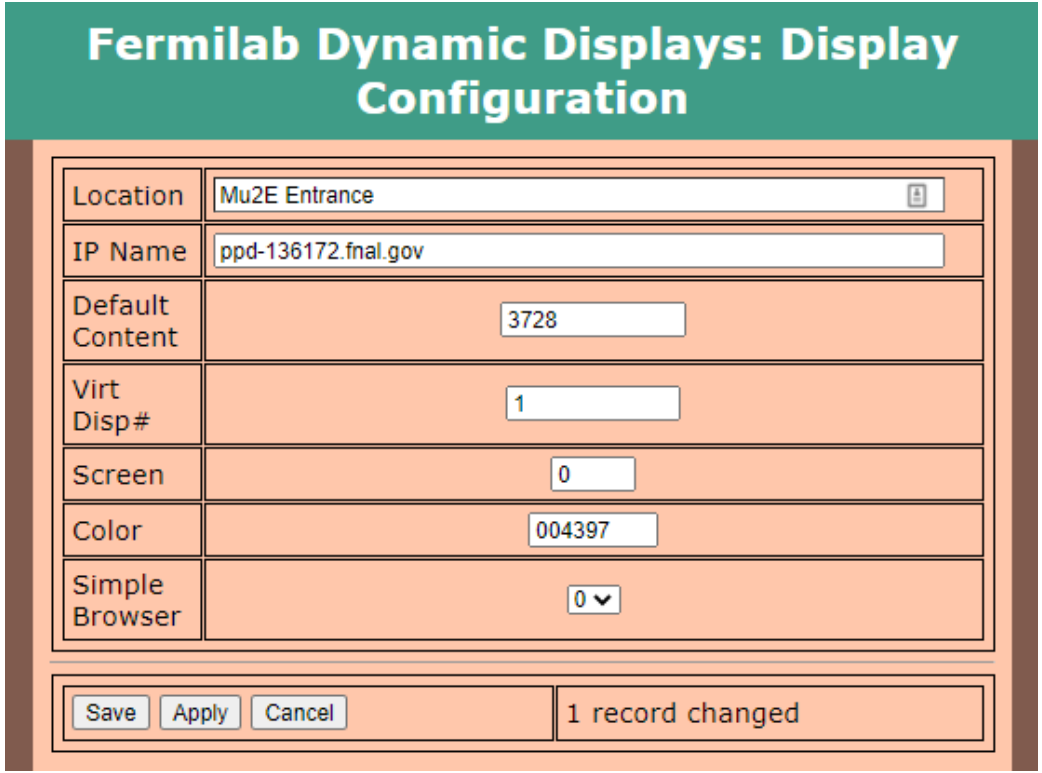
Fermilab Dynamic Displays: Display Configuration

Search		DispID	Location	IP Name	Default Content	Virt Disp#	Screen	Color	Simple Browser
Clear		Sorted By: DispID ascending							
	○	85	AD Computer Room Display 3	ad119629.fnal.gov	-12	3	0	f20019	1
	○	91	FTBF Display 1	ftbf-display-01.fnal.gov	-63	1	0	004397	1
	○	94	Test Linux PC 2 in McCrory office	ad130482.fnal.gov_IGNORE	8	1	1	004397	0
	○	96	MINOS Hall Display 2	dir-130620.fnal.gov	910	2	0	ffcc00	0
	○	98	WH10W Elevators	wh10w-display-01.fnal.gov	254	4	0	008000	1
	○	99	Mu2E Entrance	ppd-136172.fnal.gov	3728	1	0	004397	0

<< < Add View Change Copy Delete > >> Go to 4

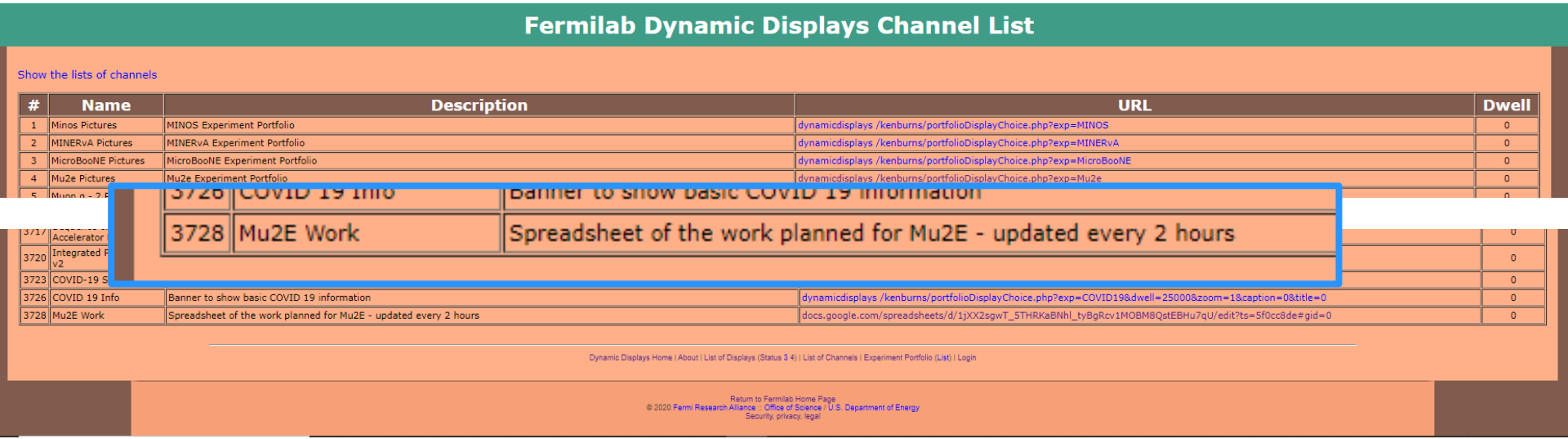
Page: 4 of 4 Records: 51

Table Display database access



Channel numbers?

- https://dynamicdisplays.fnal.gov/channelList.php



Fermilab Dynamic Displays Channel List

Show the lists of channels

#	Name	Description	URL	Dwell
1	Minos Pictures	MINOS Experiment Portfolio	dynamicdisplays /kenburns/portfolioDisplayChoice.php?exp=MINOS	0
2	MINERvA Pictures	MINERvA Experiment Portfolio	dynamicdisplays /kenburns/portfolioDisplayChoice.php?exp=MINERvA	0
3	MicroBooNE Pictures	MicroBooNE Experiment Portfolio	dynamicdisplays /kenburns/portfolioDisplayChoice.php?exp=MicroBooNE	0
4	Mu2e Pictures	Mu2e Experiment Portfolio	dynamicdisplays /kenburns/portfolioDisplayChoice.php?exp=Mu2e	0
3720	Integrated F... v2			0
3723	COVID-19 S...			0
3726	COVID 19 Info	Banner to show basic COVID 19 information	dynamicdisplays /kenburns/portfolioDisplayChoice.php?exp=COVID19&dwell=25000&zoom=1&caption=0&title=0	0
3728	Mu2E Work	Spreadsheet of the work planned for Mu2E - updated every 2 hours	docs.google.com/spreadsheets/d/1jXX2sgwT_5THRKaBNhl_tyBgRcv1MOBM8QstEBHu7qU/edit?ts=5f0cc8de#gid=0	0

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If this is something you will want to do more frequently, I can write a web page to simplify this operation.

Even more frequently? We should install a Channel Selector PC

Questions?

3. Adding new content

1. Overview: What and why
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Any web page works as content

But some work better than others

Channel = URL

- All content in the system is web pages
  - *Simple web page*
    - https://www-bd.fnal.gov/cgi-mcr/radar.comfort.pl
    - https://dynamicdisplays.fnal.gov/clock/five.html
  - ~~*Experiment Portfolio – Slide show of photos*~~
  - *YouTube video*
    - https://www.youtube.com/embed/yAwQfKe6Jgw?autoplay=1&mute=1
- A channel can also be a list of URLs
  - *E.g., intersperse two different relevant pages, add photos, web cams (?)*

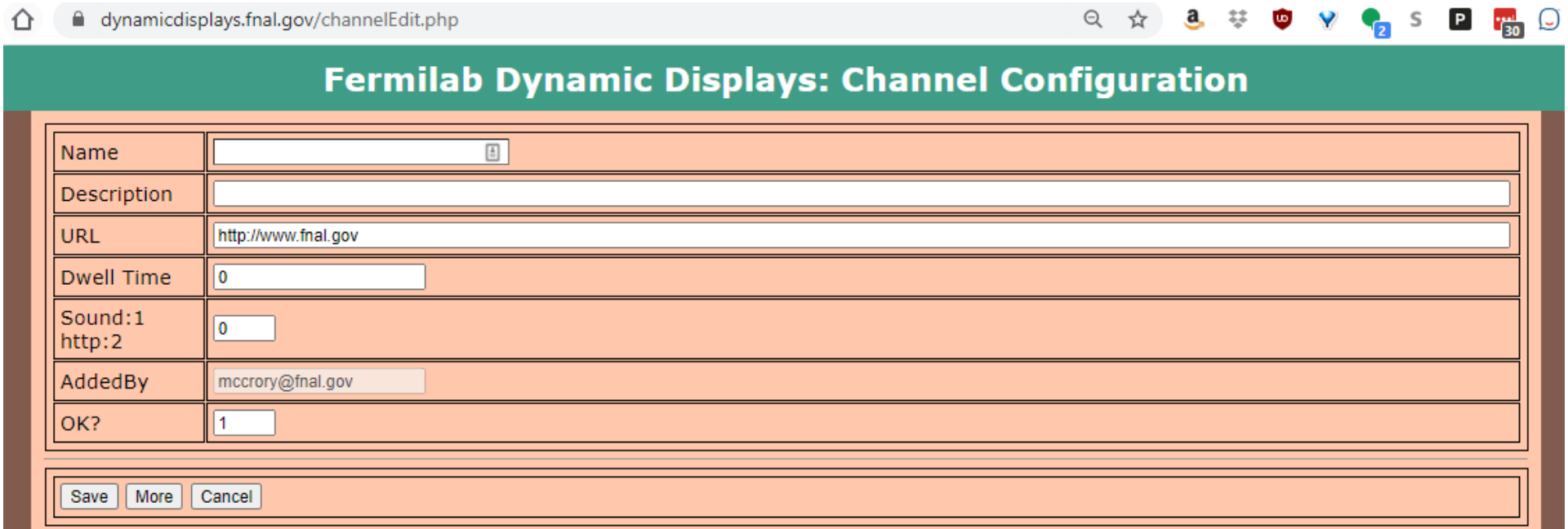
To be aware of …

- Do not web pages that require user input
  - *JNLP / Java Web Start*
    - You cannot click on the dialog box asking if it is OK to run this program
  - *Tall pages*
    - Scroll bars cannot be manipulated
  - *Amazon.com*
    - And other pages that rely heavily on user input
- Content that is behind a password wall cannot be shown
- URLs in Dynamic Displays database are limited to 255 characters
  - *Shorten with bit.ly, tinyurl.com, etc.*
- http:// content does not work very well!

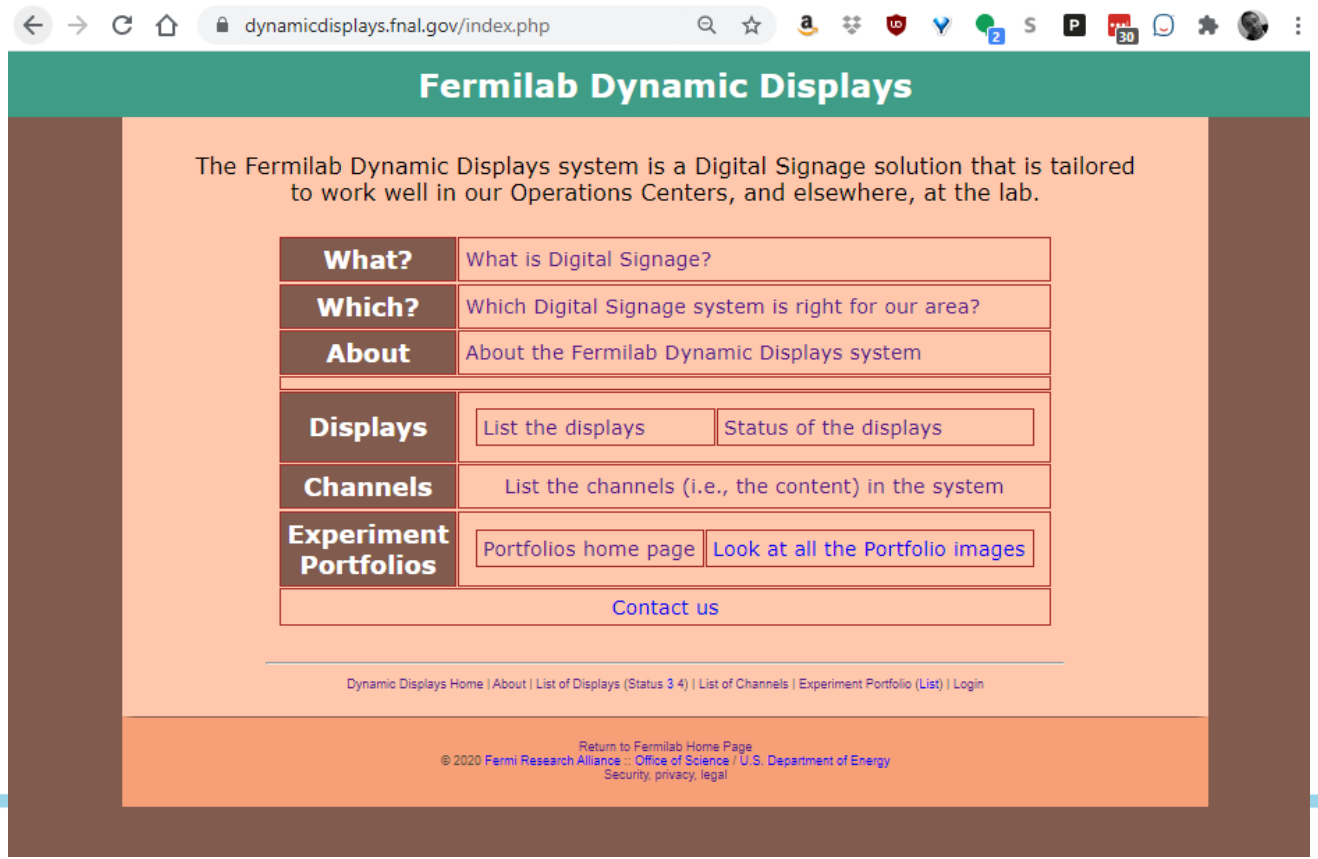
Adding a channel

- Done from a web page:

  https://dynamicdisplays.fnal.gov/channelEdit.php



An aside – the web pages for the system



No login credentials

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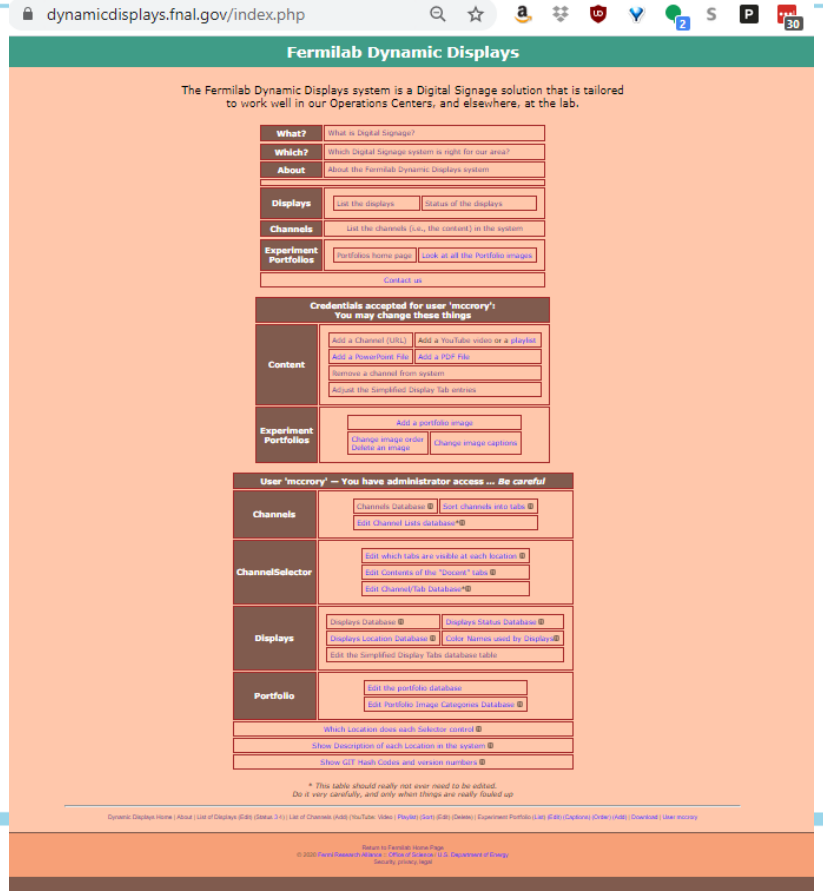
Home pg with Services credentials received



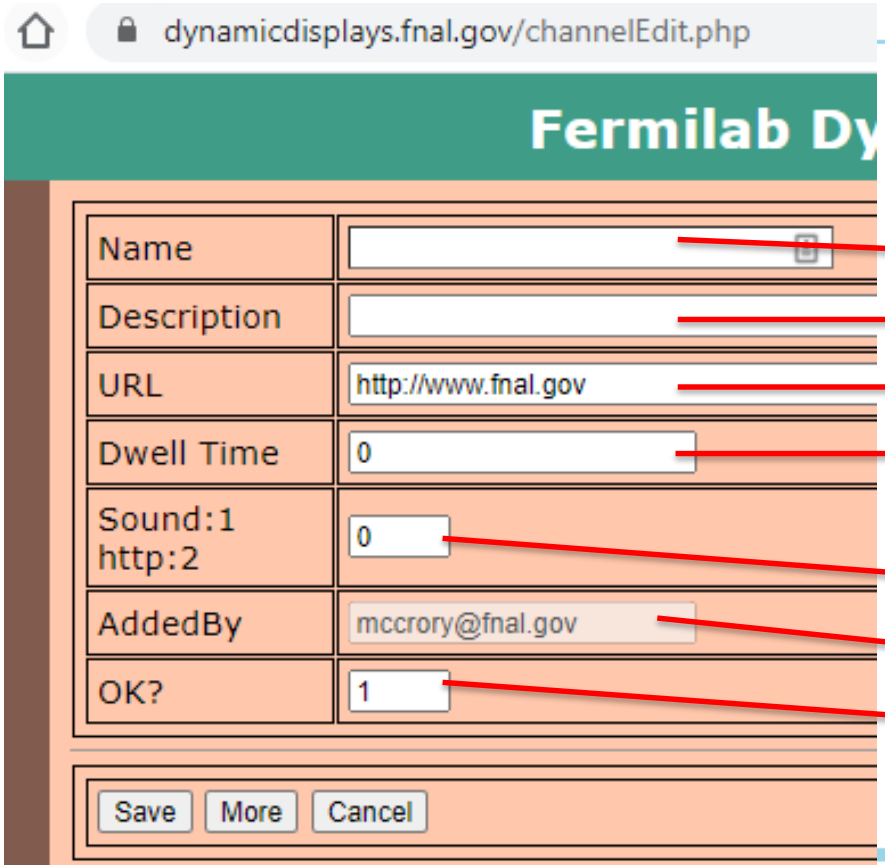
The choices here are determined by your rights. I am a full admin, so I have all possible choices.

Fermilab

Most links are in the footer:

Dynamic Displays Home | About | List of Displays (Edit) (Status 3 4) | List of Channels (Add) (YouTube: Video | Playlist) (Sort) (Edit) (Delete) | Experiment Portfolio (List) (Edit) (Captions) (Order) (Add) | Download | User mcorory

Adding a channel



- A simple name for the channel
- A long description
- The URL of the channel
- How often to refresh (Default: 2 hours)
- Sound, http
- Your email
- Approved? (Only avail to admins)

A channel can be a list of channels

- The user can create lists of channels
- Specification, for example:

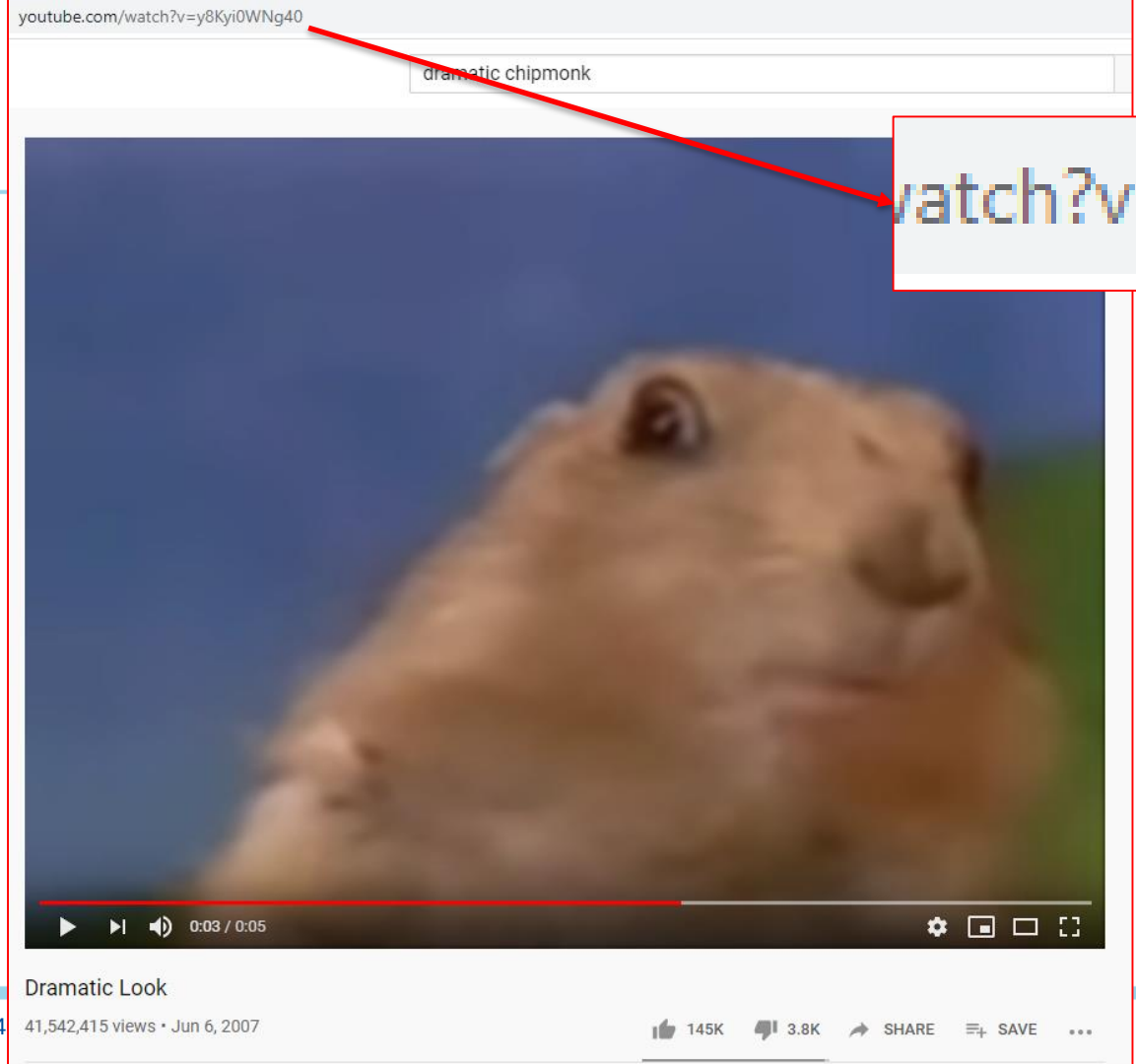
Sequence	Chan. #	Channel Description	Dwell Time
1	3389	Mu2E Schedule	10 min
2	4211	Mu2E recent faults *(fictional)*	5 min
3	89	Video cam *(fictional)*	5 min
4	23	Wall Clock	1 min

- This list repeats indefinitely

Questions?

You can also add a YouTube video

- The system is well-suited for YouTube videos
- A web page has been created to streamline adding a YouTube video to the system



watch?v=y8Kyi0WNg40

y8Kyi0WNg40

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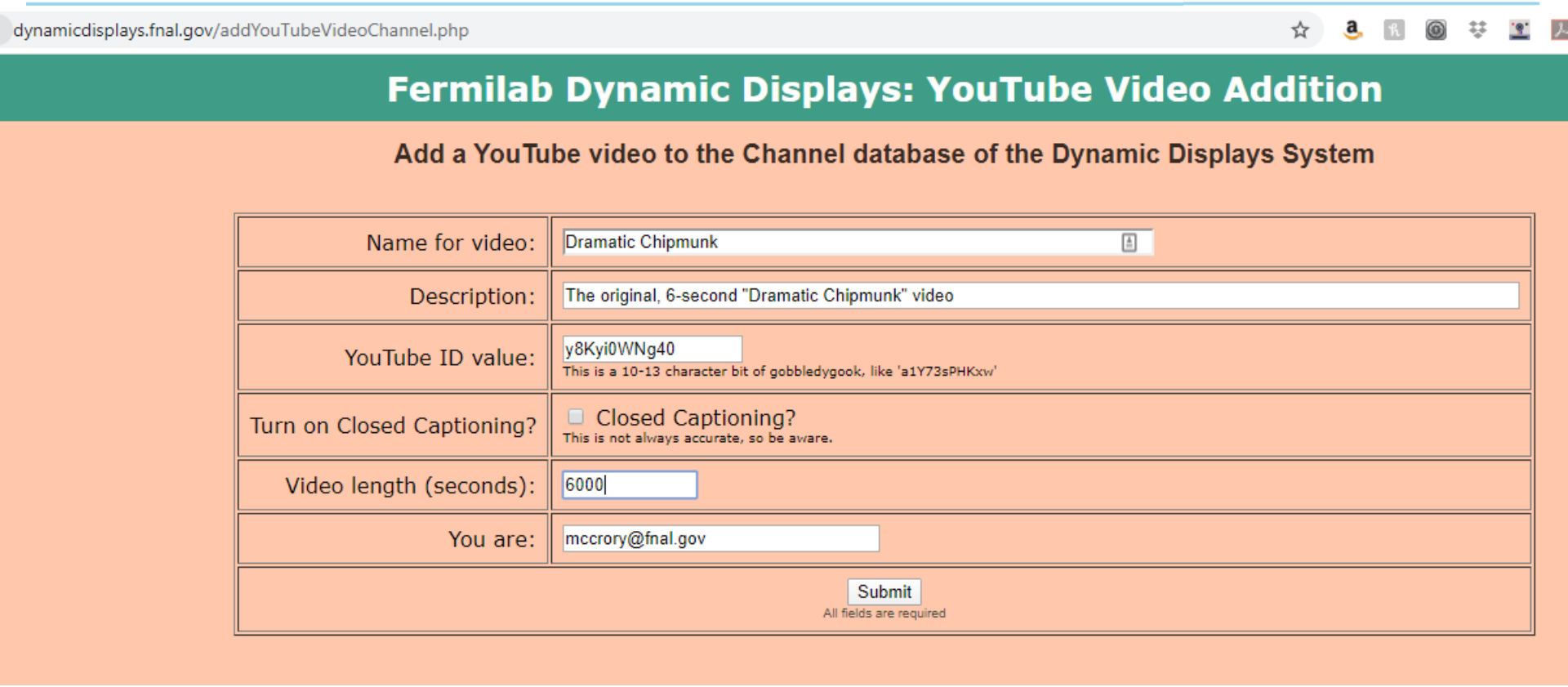
Adding YouTube video



4. Security in the Dynamic Displays system

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Security mechanisms (overview)

- Messages that direct a display to change are signed using DSA
  - *Public/private key*
- Only channels in the database, and approved, can be displayed
  - *And all Portfolio additions must be approved, too.*
- The database is password-protected, and it is not visible from off-site.

Is this good enough?

- Yes
  - *Passed CD security review in 2015*
- But we are probably not secure against an evil genius

- The Computing Sector port scans have uncovered some subtle problems, which have been corrected.

5. An Interesting Feature: Emergency messages

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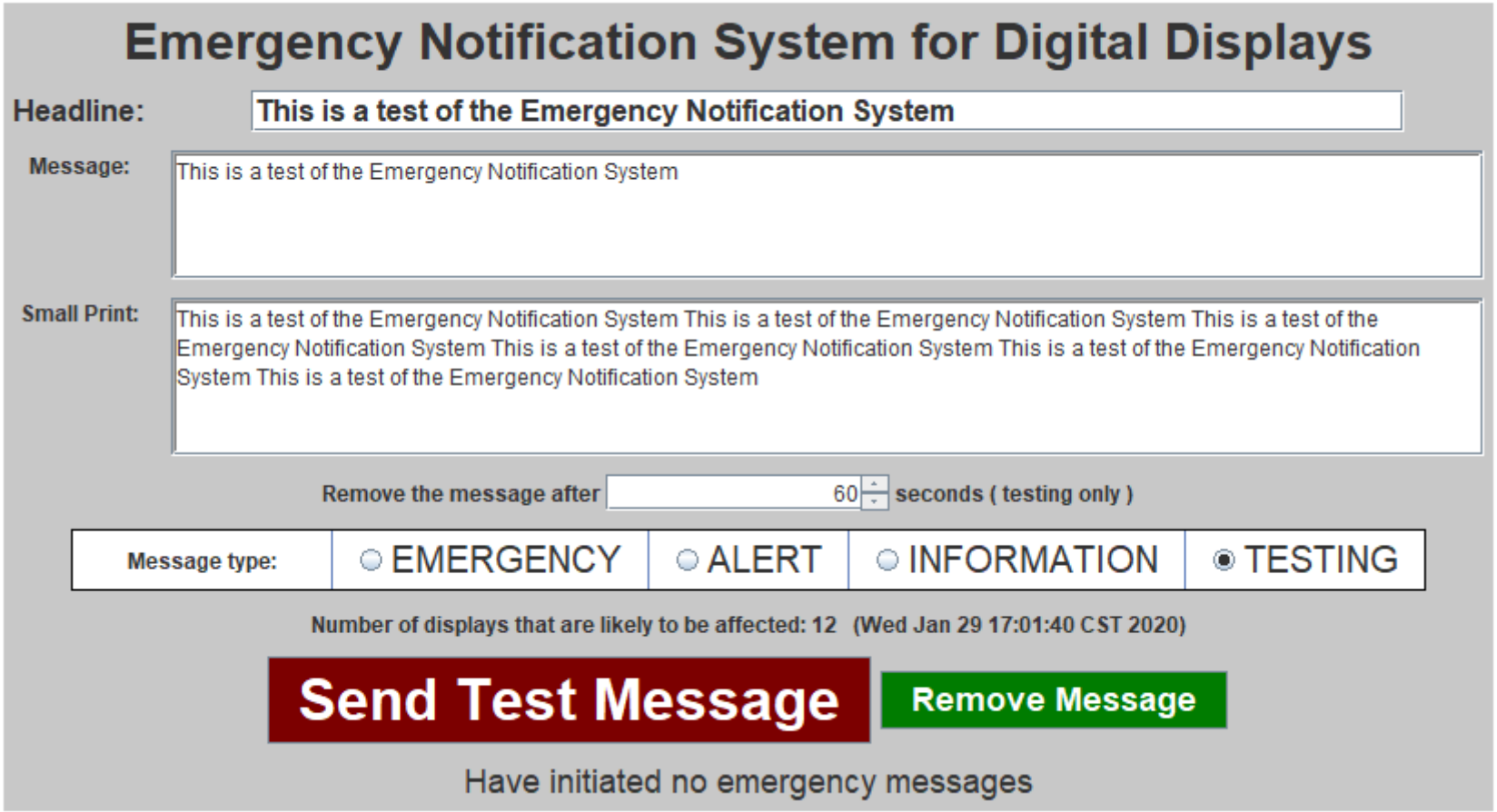
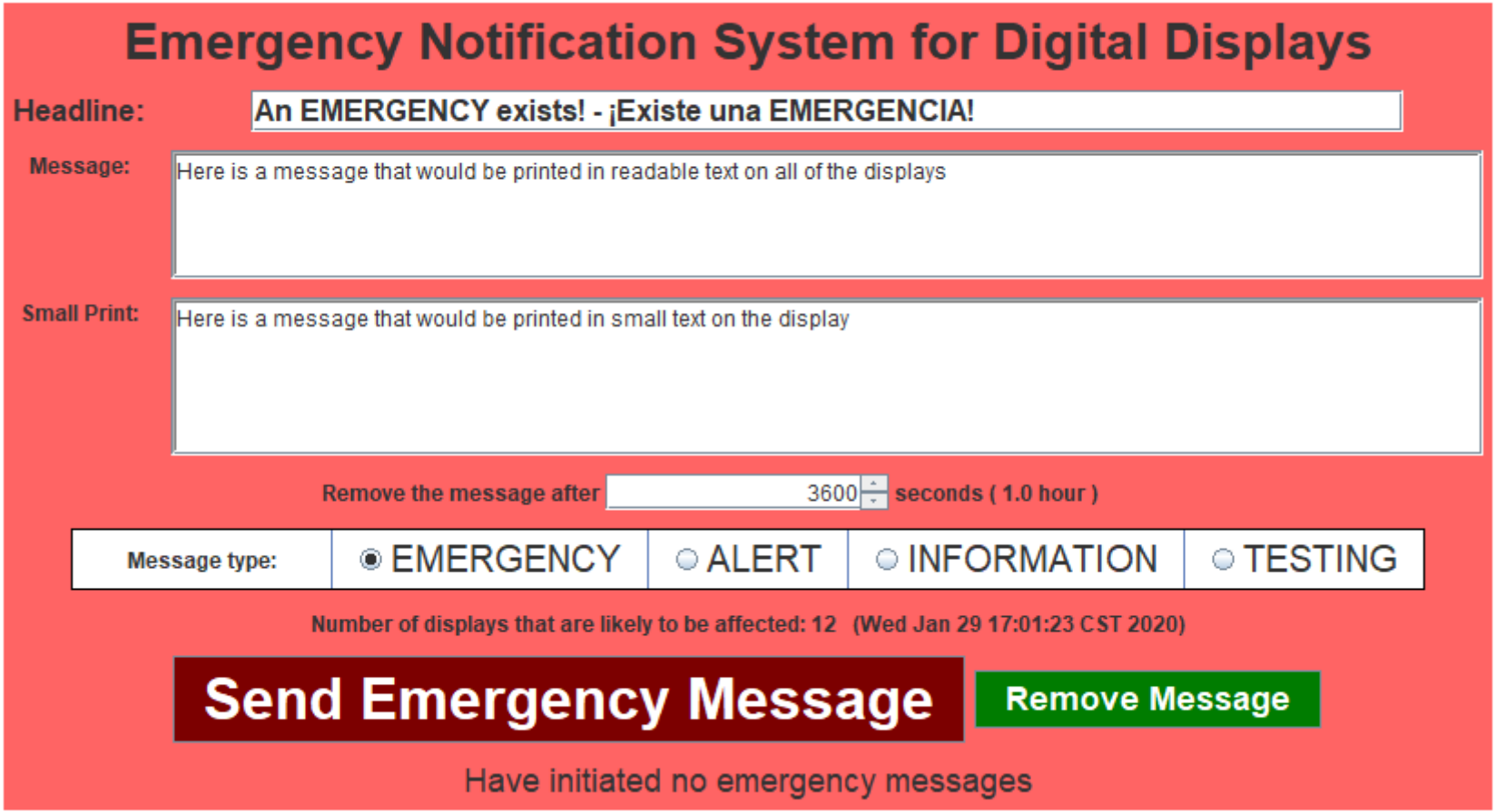
Emergency Message

- A properly-authorized user (e.g., The Office of Communications) can send an emergency message to all displays in the system.
- Here is a test I did back in January in the ROC-W:


Emergency Notification System for Digital Displays
Headline:
This is a test of the Emergency Notification System
Message:
This is a test of the Emergency Notification System
Small Print:
This is a test of the Emergency Notification System This is a test of the Emergency Notification System This is a test of the Emergency Notification System This is a test of the Emergency Notification System This is a test of the Emergency Notification System This is a test of the Emergency Notification System
Remove the message after
60
seconds (testing only)
Message type:
EMERGENCY
ALERT
INFORMATION
TESTING
Number of displays that are likely to be affected: 12 (Wed Jan 29 17:01:40 CST 2020)
Send Test Message
Remove Message
Have initiated no emergency messages


Emergency Notification System for Digital Displays
Headline:
An EMERGENCY exists! - ¡Existe una EMERGENCIA!
Message:
Here is a message that would be printed in readable text on all of the displays
Small Print:
Here is a message that would be printed in small text on the display
Remove the message after 3600 seconds (1.0 hour)
Message type:
EMERGENCY
ALERT
INFORMATION
TESTING
Number of displays that are likely to be affected: 12 (Wed Jan 29 17:01:23 CST 2020)
Send Emergency Message
Remove Message
Have initiated no emergency messages

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Thanks!

Do you want more?

I am offering a 7-session (7-10 hour) class in the New Year.

And I am usually available via email.